



SGM3167

600MHz, Low Voltage SPDT Analog Switch in 6-pin SC70

GENERAL DESCRIPTION

The SGM3167 is a single, bidirectional, single-pole/double-throw (SPDT) CMOS analog switches designed to operate from a single 1.8V to 5.5V supply. It features high-bandwidth (600MHz) and low on-resistance (9Ω TYP), targeted applications for audio switching.

SGM3167 features guaranteed on-resistance matching (0.3Ω max) between switches and guaranteed on-resistance flatness over the signal range (2.5Ω TYP). This ensures excellent linearity and low distortion when switching audio signals.

SGM3167 is available in a SC70-6 package.

APPLICATIONS

- Portable Instrumentation
- Battery-Operated Equipment
- Computer Peripherals
- Cell Phones
- PDA's
- MP3's

FUNCTION TABLE

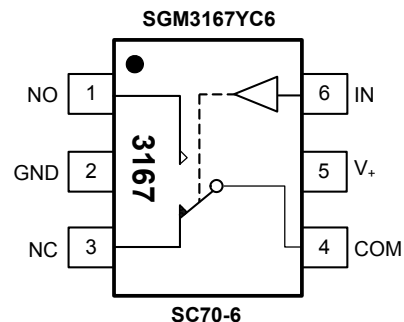
| LOGIC | NO | NC |
|-------|-----|-----|
| 0 | OFF | ON |
| 1 | ON | OFF |

Switches Shown For Logic "0" Input

FEATURES

- **Voltage Operation: 1.8V to 5.5V**
- **On-Resistance: 9Ω (TYP) at 5.0V**
- **Fast Switching Times**
 t_{ON} 20ns
 t_{OFF} 15ns
- **High Bandwidth: 600MHz**
- **High Off-Isolation: -63dB at 10MHz**
- **Rail-to-Rail Operation**
- **TTL/CMOS Compatible**
- **Break-Before-Make Switching**
- **Extended Industrial Temperature Range:**
 $-40^{\circ}C$ to $+85^{\circ}C$
- **Lead (Pb) Free SC70-6 Package**

PIN CONFIGURATION (TOP VIEW)



PIN DESCRIPTION

| NAME | PIN | FUNCTION |
|------|-----|---|
| NO | 1 | Normally-open terminal |
| GND | 2 | Ground |
| NC | 3 | Normally-closed terminal |
| COM | 4 | Common terminal |
| V+ | 5 | Power supply |
| IN | 6 | Digital control pin to connect the COM terminal to the NO or NC terminals |

Note: NO, NC and COM terminal may be an input or output.

ORDERING INFORMATION

| MODEL | PIN-PACKAGE | SPECIFIED TEMPERATURE RANGE | ORDERING NUMBER | PACKAGE MARKING | PACKAGE OPTION |
|---------|-------------|-----------------------------|-----------------|-----------------|---------------------|
| SGM3167 | SC70-6 | -40°C to +85°C | SGM3167YC6/TR | 3167 | Tape and Reel, 3000 |

Note: SC70-6 package is same as SOT-363 package.

ABSOLUTE MAXIMUM RATINGS

| | | | |
|--|----------------------|--|-----------------|
| V+, IN to GND..... | -0.3V to 6V | Junction Temperature..... | 150°C |
| Analog, Digital voltage range ⁽¹⁾ | -0.3V to (V+) + 0.3V | Storage Temperature..... | -65°C to +150°C |
| Continuous Current NO, NC, or COM..... | ±30mA | Lead Temperature (soldering, 10s)..... | 260°C |
| Peak Current NO, NC, or COM..... | ±50mA | ESD (HBM)..... | 2000V |
| Operating Temperature Range..... | -40°C to +85°C | ESD (MM)..... | 400V |

Stresses beyond those listed under “Absolute Maximum Ratings” may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability. (1) Signals on NC, NO, or COM or IN exceeding V+ will be clamped by internal diodes. Limit forward diode current to maximum current ratings.

CAUTION

This integrated circuit can be damaged by ESD if you don't pay attention to ESD protection. SGMICRO recommends that all integrated circuits be handled with appropriate precautions. Failure to observe proper handling and installation procedures can cause damage.

ESD damage can range from subtle performance degradation to complete device failure. Precision integrated circuits may be more susceptible to damage because very small parametric changes could cause the device not to meet its published specifications.

ELECTRICAL CHARACTERISTICS

(V_+ = +4.5V to +5.5V, V_{IH} = +2.0V, V_{IL} = +0.8V, T_A = -40°C to +85°C, Typical values are at V_+ = 5.0V, T_A = +25°C, unless otherwise noted.)

| PARAMETER | SYMBOL | CONDITIONS | TEMP | MIN | TYP | MAX | UNITS |
|--------------------------------------|---------------------------------------|--|----------------|-------|-----|-------|----------|
| ANALOG SWITCH | | | | | | | |
| Analog Signal Range | V_{NO}, V_{NC}, V_{COM} | | -40°C to +85°C | 0 | | V_+ | V |
| On-Resistance | R_{ON} | V_+ = 4.5V, V_{NO} or V_{NC} = 3.5V, I_{COM} = -10mA, Test Circuit 1 | +25°C | | 9 | 14 | Ω |
| | | | -40°C to +85°C | | | 16 | Ω |
| On-Resistance Match Between Channels | ΔR_{ON} | V_+ = 4.5V, V_{NO} or V_{NC} = 3.5V, I_{COM} = -10mA, Test Circuit 1 | +25°C | | 0.3 | 0.6 | Ω |
| | | | -40°C to +85°C | | | 0.8 | Ω |
| On-Resistance Flatness | $R_{FLAT(ON)}$ | V_+ = 4.5V, V_{NO} or V_{NC} = 1.0V, 2.0V, 3.5V, I_{COM} = -10mA, Test Circuit 1 | +25°C | | 2 | 2.6 | Ω |
| | | | -40°C to +85°C | | | 3 | Ω |
| Source OFF Leakage Current | $I_{NC(OFF)}, I_{NO(OFF)}$ | V_+ = 5.5V, V_{NO} or V_{NC} = 1.0V, 4.5V, V_{COM} = 4.5V, 1.0V | -40°C to +85°C | | | 1 | μ A |
| Channel ON Leakage Current | $I_{NC(ON)}, I_{NO(ON)}, I_{COM(ON)}$ | V_+ = 5.5V, V_{COM} = 1.0V, 4.5V, V_{NO} or V_{NC} = 1.0V, 4.5V, or floating | -40°C to +85°C | | | 1 | μ A |
| DIGITAL INPUTS | | | | | | | |
| Input High Voltage | V_{INH} | | -40°C to +85°C | 1.5 | | | V |
| Input Low Voltage | V_{INL} | | -40°C to +85°C | | | 0.6 | V |
| Input Leakage Current | I_{IN} | V_+ = 5.5V, V_{IN} = 0V or 5.5V | -40°C to +85°C | | | 1 | μ A |
| DYNAMIC CHARACTERISTICS | | | | | | | |
| Turn-On Time | t_{ON} | V_{NO} or V_{NC} = 3.0V, V_{IH} = 1.5V, V_{IL} = 0V, R_L = 300 Ω , C_L = 35pF, Test Circuit 2 | +25°C | | 20 | | ns |
| Turn-Off Time | t_{OFF} | V_{NO} or V_{NC} = 3.0V, V_{IH} = 1.5V, V_{IL} = 0V, R_L = 300 Ω , C_L = 35pF, Test Circuit 2 | +25°C | | 15 | | ns |
| Break-Before-Make Time Delay | t_D | V_{NO1} or V_{NC1} = V_{NO2} or V_{NC2} = 3V, R_L = 300 Ω , C_L = 35pF, Test Circuit 3 | +25°C | | 5 | | ns |
| Skew | t_{SKEW} | R_S = 39 Ω , C_L = 50pF, Test Circuit 4 | +25°C | | 5 | | ns |
| Off Isolation | O_{ISO} | R_L = 50 Ω , V_{NO} or V_{NC} = 1V _{P-P} , C_L = 5pF, Test Circuit 5 | f = 10MHz | +25°C | | -63 | dB |
| | | | f = 1MHz | +25°C | | -83 | dB |
| -3dB Bandwidth | BW | Signal = 0dBm, R_L = 50 Ω , C_L = 5pF, Test Circuit 6 | +25°C | | 600 | | MHz |
| Source OFF Capacitance | $C_{NC(OFF)}, C_{NO(OFF)}$ | f = 1MHz | +25°C | | 5.5 | | pF |
| Channel ON Capacitance | $C_{NC(ON)}, C_{NO(ON)}, C_{COM(ON)}$ | f = 1MHz | +25°C | | 9 | | pF |
| POWER REQUIREMENTS | | | | | | | |
| Power Supply Range | V_+ | | -40°C to +85°C | 1.8 | | 5.5 | V |
| Power Supply Current | I_+ | V_+ = +5.5V, V_{IN} = 0V or V_+ | -40°C to +85°C | | | 5 | μ A |

Specifications subject to change without notice.

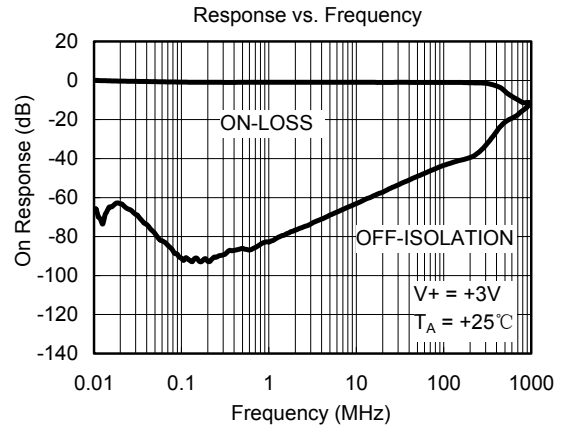
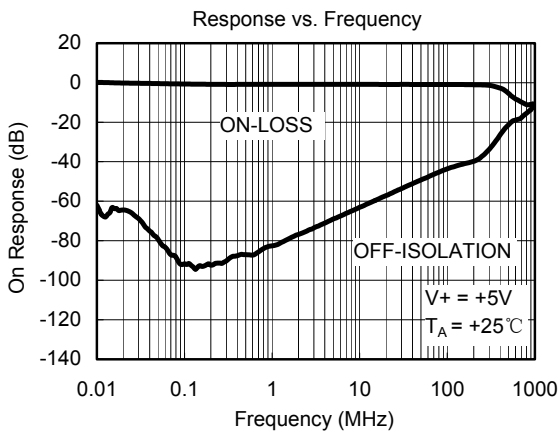
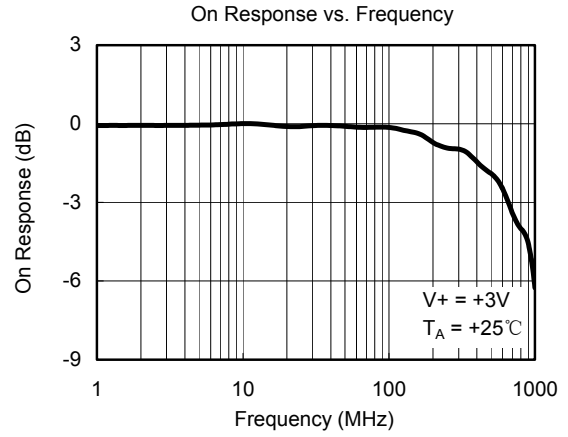
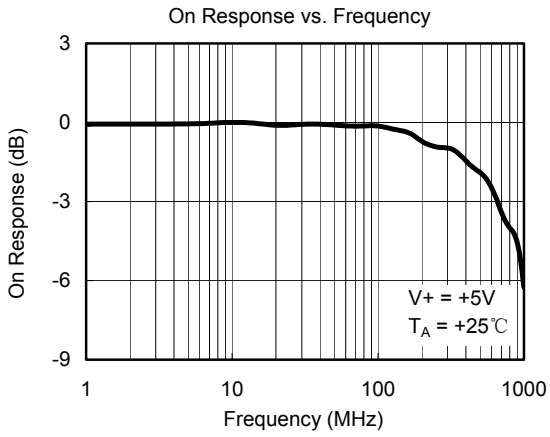
ELECTRICAL CHARACTERISTICS

(V_+ = +2.7V to +3.6V, V_{IH} = +1.4 V, V_{IL} = +0.5V, T_A = -40°C to +85°C, Typical values are at V_+ = 3.0V, T_A = +25°C, unless otherwise noted.)

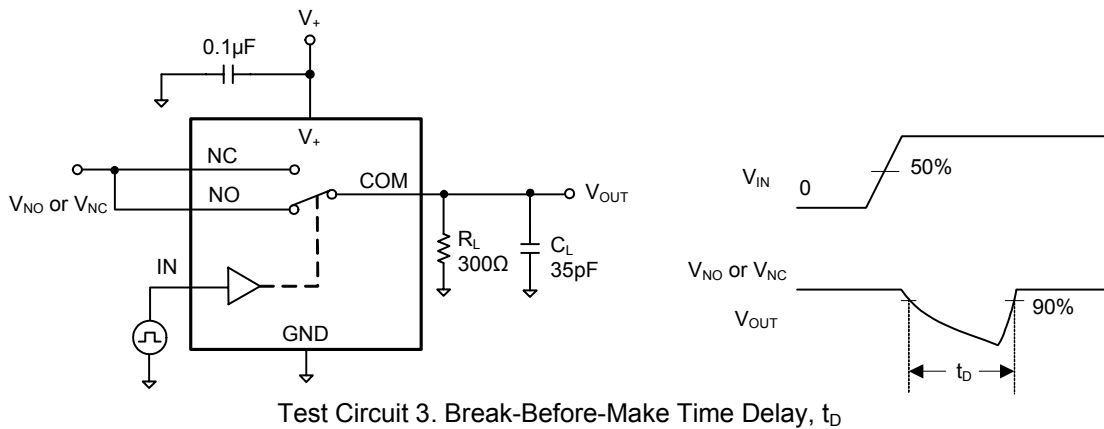
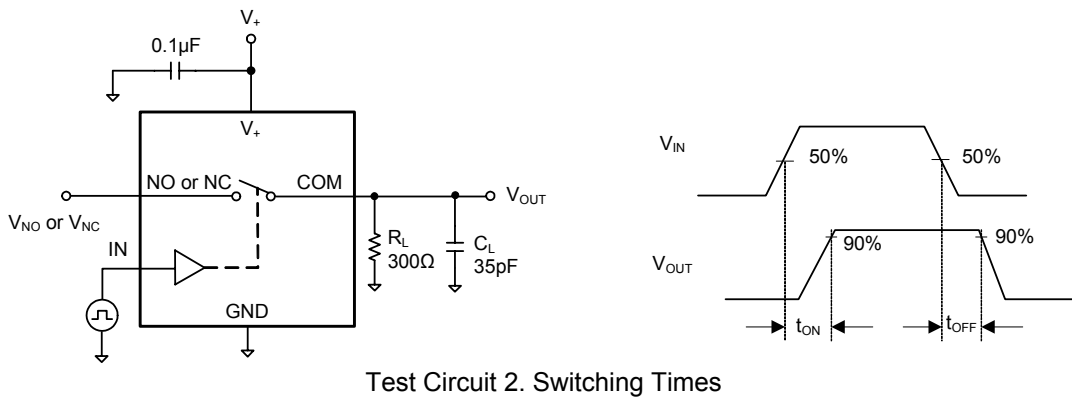
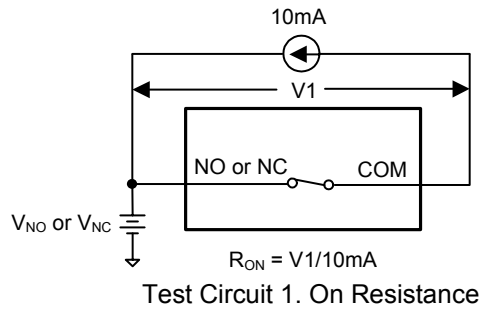
| PARAMETER | SYMBOL | CONDITIONS | TEMP | MIN | TYP | MAX | UNITS |
|---|--|---|----------------|-------|-----|-------|----------|
| ANALOG SWITCH | | | | | | | |
| Analog Signal Range | V_{NO}, V_{NC}, V_{COM} | | -40°C to +85°C | 0 | | V_+ | V |
| On-Resistance | R_{ON} | V_+ = 2.7V, V_{NO} or V_{NC} = 1.5V, I_{COM} = -10mA, Test Circuit 1 | +25°C | | 14 | 25 | Ω |
| | | | -40°C to +85°C | | | 28 | Ω |
| On-Resistance Match Between Channels | ΔR_{ON} | V_+ = 2.7V, V_{NO} or V_{NC} = 1.5V, I_{COM} = -10mA, Test Circuit 1 | +25°C | | 0.3 | 0.6 | Ω |
| | | | -40°C to +85°C | | | 0.8 | Ω |
| On-Resistance Flatness | $R_{FLAT(ON)}$ | V_+ = 2.7V, V_{NO} or V_{NC} = 1.0V, 1.5V, 2.0V, I_{COM} = -10mA, Test Circuit 1 | +25°C | | 2.5 | 8 | Ω |
| | | | -40°C to +85°C | | | 10 | Ω |
| Source OFF Leakage Current | $I_{NC(OFF)}, I_{NO(OFF)}$ | V_+ = 3.6V, V_{NO} or V_{NC} = 0.3V, 3.3V, V_{COM} = 3.3V, 0.3V, | -40°C to +85°C | | | 1 | μ A |
| Channel ON Leakage Current | $I_{NC(ON)}, I_{NO(ON)},$ $I_{COM(ON)}$ | V_+ = 3.6V, V_{COM} = 0.3V, 3.3V, V_{NO} or V_{NC} = 0.3V, 3.3V, or floating | -40°C to +85°C | | | 1 | μ A |
| DIGITAL INPUTS | | | | | | | |
| Input High Voltage | V_{INH} | | -40°C to +85°C | 1 | | | V |
| Input Low Voltage | V_{INL} | | -40°C to +85°C | | | 0.5 | V |
| Input Leakage Current | I_{IN} | V_+ = 5.5V, V_{IN} = 0V or 3.6V | -40°C to +85°C | | | 1 | μ A |
| DYNAMIC CHARACTERISTICS | | | | | | | |
| Turn-On Time | t_{ON} | V_{NO} or V_{NC} = 1.5V, V_{IH} = 1.5V, V_{IL} = 0V, R_L = 300 Ω , C_L = 35pF, Test Circuit 2 | +25°C | | 30 | | ns |
| Turn-Off Time | t_{OFF} | V_{NO} or V_{NC} = 1.5V, V_{IH} = 1.5V, V_{IL} = 0V, R_L = 300 Ω , C_L = 35pF, Test Circuit 2 | +25°C | | 25 | | ns |
| Break-Before-Make Time Delay | t_D | V_{NO1} or V_{NC1} = V_{NO2} or V_{NC2} = 3V, R_L = 300 Ω , C_L = 35pF, Test Circuit 3 | +25°C | | 8 | | ns |
| Skew | t_{SKEW} | R_S = 39 Ω , C_L = 50pF, Test Circuit 4 | +25°C | | 2 | | ns |
| Off Isolation | O_{ISO} | R_L = 50 Ω , V_{NO} or V_{NC} = 1V _{P-P} , C_L = 5pF, Test Circuit 5 | f = 10MHz | +25°C | | -63 | dB |
| | | | f = 1MHz | +25°C | | -83 | dB |
| -3dB Bandwidth | BW | Signal = 0dBm, R_L = 50 Ω , C_L = 5pF, Test Circuit 6 | +25°C | | 600 | | MHz |
| Source OFF Capacitance | $C_{NC(OFF)},$ $C_{NO(OFF)}$ | f = 1MHz | +25°C | | 5.5 | | pF |
| Channel ON Capacitance | $C_{NC(ON)}, C_{NO(ON)},$ $C_{COM(ON)}$ | f = 1MHz | +25°C | | 9 | | pF |
| POWER REQUIREMENTS | | | | | | | |
| Power Supply Range | V_+ | | -40°C to +85°C | 1.8 | | 5.5 | V |
| Power Supply Current | I_+ | V_+ = +5.5V, V_{IN} = 0V or V_+ | -40°C to +85°C | | | 5 | μ A |

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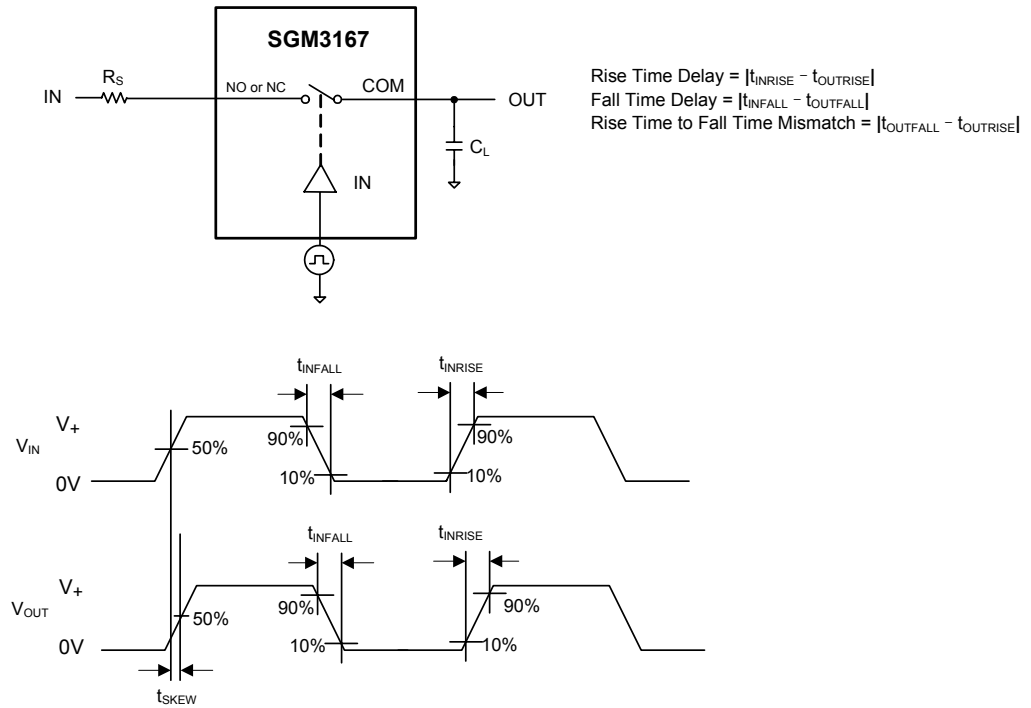
TYPICAL PERFORMANCE CHARACTERISTICS



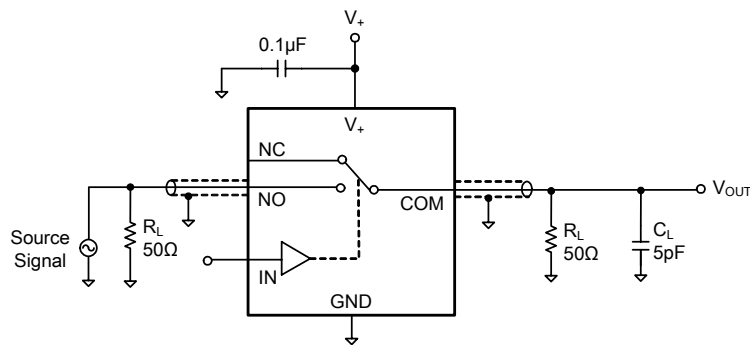
TEST CIRCUITS



TEST CIRCUITS (Cont.)

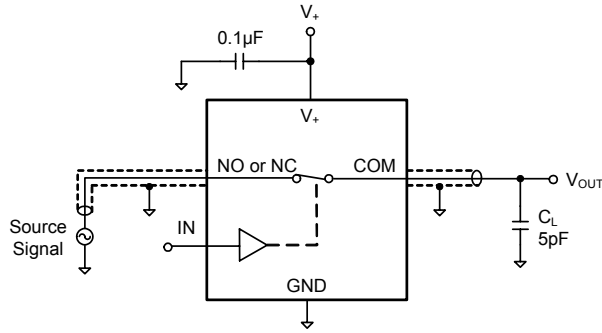


Test Circuit 4. Output Signal Skew



Test Circuit 5. Off Isolation

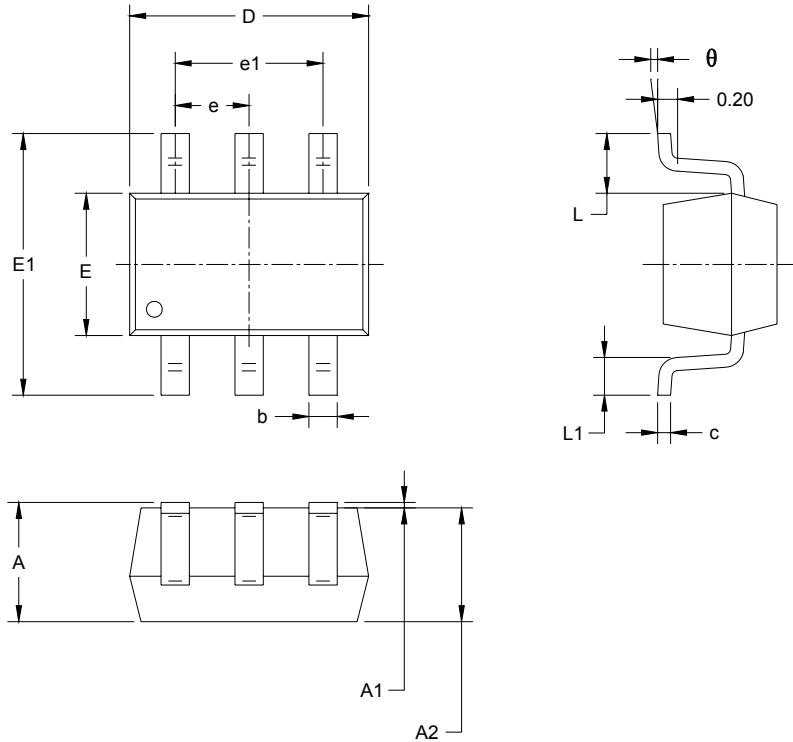
TEST CIRCUITS (Cont.)



Test Circuit 6. -3dB Bandwidth

PACKAGE OUTLINE DIMENSIONS

SC70-6 / SOT-363



| Symbol | Dimensions In Millimeters | | Dimensions In Inches | |
|--------|------------------------------|-------|-------------------------|-------|
| | MIN | MAX | MIN | MAX |
| A | 0.900 | 1.100 | 0.035 | 0.043 |
| A1 | 0.000 | 0.100 | 0.000 | 0.004 |
| A2 | 0.900 | 1.000 | 0.035 | 0.039 |
| b | 0.150 | 0.350 | 0.006 | 0.014 |
| c | 0.080 | 0.150 | 0.003 | 0.006 |
| D | 2.000 | 2.200 | 0.079 | 0.087 |
| E | 1.150 | 1.350 | 0.045 | 0.053 |
| E1 | 2.150 | 2.450 | 0.085 | 0.096 |
| e | 0.65 TYP | | 0.026 TYP | |
| e1 | 1.300 BSC | | 0.051 BSC | |
| L | 0.525 REF | | 0.021 REF | |
| L1 | 0.260 | 0.460 | 0.010 | 0.018 |
| θ | 0° | 8° | 0° | 8° |

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SGMICRO is dedicated to provide high quality and high performance analog IC products to customers. All SGMICRO products meet the highest industry standards with strict and comprehensive test and quality control systems to achieve world-class consistency and reliability.

For more information regarding SGMICRO Corporation and its products, please visit www.sg-micro.com